THE QUESTION OF PROTOPATHIC AND EPICRITIC SENSIBILITY AND THE DISTRIBUTION OF THE TRIGEMINUS NERVE (THIRD BRANCH).

BY CHARLES L. DANA, M.D.,

OF NEW YORK.

In the summer number of *Brain,* 1905, Drs. Henry Head, W. H. R. Rivers and Joseph Sherren, publish a monograph, entitled "The Afferent Nervous System from a New Aspect." The work is a most elaborate and painstaking one, amounting practically to a volume, and I cannot attempt here either to summarize or criticise it with any completeness. Briefly, the contention is that the afferent nervous system is composed of three different systems, which conduct to the brain different forms of sensibility.

1. A protopathic system of the skin which consists of afferent fibres running, as I understand, in connection with the sympathetic and the vessels, and supplying the skin with a low degree of sensibility. This is called the somatic part of the protopathic system. There is a visceral part of the protopathic system, which supplies a low degree of sensibility to the viscera. This is identical with the sensory fibers of the sympathetic.

2. A protopathic system which consists of a set of fibers that supply the sense of movement, of deep pressure and appreciation of position, of muscles, tendons and joints. These fibers are connected with the Paccinian bodies, and they run in the motor nerves.

The "protopathic system," then as a whole, consists of fibers of sensibility which supply the skin, the viscera, and all parts of the body, inside and out. It furnishes a low degree of sensibility to the viscera and to the skin, and a special "deep" kind of sensibility to the muscles, joints and tendons. This system enables one to appreciate a sense of pain, and temperature, and location, and position, though not to a very delicate extent.

3. There is another system of afferent fibers which supply the skin alone, a purely cutaneous system, and this is called *epicritic.* This epicritic sensibility enables us to appreciate light touch, the

points of the compass, localization, and minor degrees of temperature, ranging between 22° and 40° C.

Both systems seem to be able to appreciate the sense of pain, but the epicritic sensibility furnishes a more delicate and localized appreciation. Protopathic fibers carry sensations which are badly localized, widely diffused, and sometimes referred to other parts than that of the stimulation. The protopathic fibers are incapable of appreciating light touch, and minor degrees of heat and cold, and pain appreciation is a diffuse tingling and thrilling sensation.

The material upon which this theory is based, consists of a large number of very carefully studied cases of injuries of the peripheral nerves of the limbs; also of two cases of loss of sensation by division of posterior roots. No studies have been made, apparently, of the very striking cases of section by the surgeon of the trigeminal nerve. In fact, I can find no reference of the application of the theory to the trigeminus. The authors state, however, that "the whole body, within and without," is supplied by the protopathic system, and that one set of fibers of this system—those which go to the skin—is identical with the afferent fibers of the sympathetic in the viscera. Another set, which is connected with the deep sensibility, runs in conjunction with the motor nerves. If this be the case for the trigeminal nerve, then it would seem that a clean-cut section of this nerve, such as is made by surgeons, should destroy all the epicritic sensibility, but would leave some, at least, of the protopathic sensibility, that is, an appreciation of movement, of position, of deep pressure, and perhaps some degree of appreciation of extremes of temperature and pain.

The following case has interested me in connection with this theory, and also because of its showing the rather unique distribution of the inferior branch of the trigeminal nerve. So far as it goes, it seems to show that every form of sensibility which it is possible to test, is lost when the nerve is cut close at the ganglion.

My tests were made on four consecutive occasions, with the greatest possible care, and upon a man of great intelligence, who cöoperated with me in the examination. So that, however true the views may be as to the differentiation of afferent nerves into two kinds, as applied to the body and limbs, it does not seem to apply to the head. A very careful examination made of the sensory condition in a complete paralysis of the seventh nerve, has shown also that with the paralysis of this nerve, there is no loss of the deep sensibility or sense of position.

In a case of major hysteria, with anesthesia of the trigeminus, there was an absolute loss of all forms of sensibility, both deep and superficial, and while this case does not prove anything, it would seem rather natural to suppose, that if there is a differentiation of sensibility into two types, they would be unmasked somewhat, in anesthesia due to a mental state, especially as the epicritic sensibility is apparently one of later development.

In cases of disease of the medulla and pons, in which there is often a very striking differentiation of sensibility, so that temperature, and pain, and touch are differently appreciated, the loss of the sense of temperature, for example, may be absolute, showing that, at least, in the central parts of the nervous system, the paths for the conduction of temperature sensations, are paths which conduct all degrees of sensation, whether mild or severe, whether very hot or only slightly warm.

In my examinations of cases of anesthesia from cerebral hemorrhage, involving more or less the posterior segment of the internal capsule, the changes in the sensibility are not in accordance with the division established by the authors of the monograph referred to. So that it would seem, at least, that if there is a differentiation of the two kinds of sensibility, it is confined to the specific arrangement of the spinal nerves, while the central nervous system and cranial nerves conduct the sensations in a different way.

Care of Section of the Lower, Third Branch of the Trigeminus.

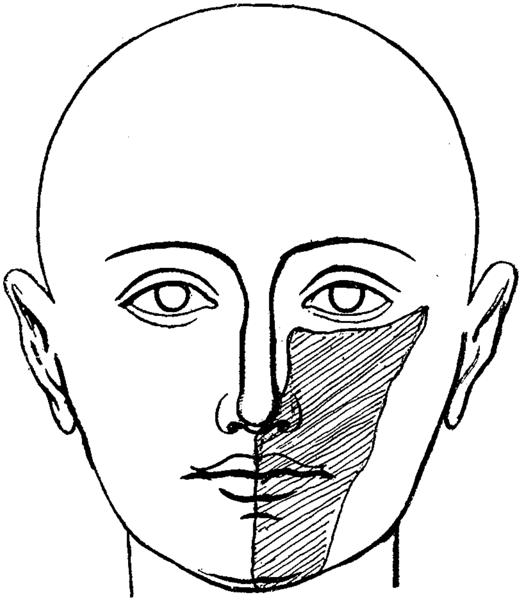
Isolated lesions of the third branch of the fifth nerve are, I believe, rather rare. I know of no case (though I have not gone over all of Cushing's), in which so clean cut an isolation has been obtained as in that which I shall now report. It has an interest from two points of view: First, that of the sensory distribution of the third branch, and, Second, that of the question of the differentiation of sensations into "protopathic" and "epicritic."

The patient, upon whom the following tests were made, was a man of 64 years of age, who had suffered for five years from an inveterate tic douloureux, involving only the inferior branch. The pain began at the mental foramen; it then went to the tongue and from there shot back to the ear. Under a treatment of rest, with massive doses of strychnia, all the shooting pains nearly ceased, but he was left with a persistent pain and soreness at the base of the left side of the tongue. This hyperesthesia was so distressing that it made talking and chewing very uncomfortable, and gave him little peace, even when he was perfectly still.

It was therefore determined to operate, and Dr. Robert Abbé performed the operation which he uses for these cases. The cranium was trephined and the opening enlarged with a rongeur, the dura mater peeled up from the bottom of the skull until the third branch of the trigeminus was seen issuing from the dura. It was cut cleanly off (a fact corroborated by Dr. W. S. Schley, who was present and assisted at the operation), without the involvement of any other branch, and the foramen plugged with rubber tissue. The patient made an excellent recovery, and was from the first, free of his soreness and pain. Three days, five days, seven days and eleven days after the operation, I made a series of tests, to determine the distribution and character of the anaesthesia which resulted. I found a total anesthesia of the chin, just below and extending a little externally to the mouth. Also, an area of anaesthesia involving the upper lip and a portion of the inside of the nose and cheek, radiating towards the ear about half way and within about an inch of the eyelid. There was also anesthesia on the mucous membrane of the mouth and tongue. This involved the whole inner surface of the mouth and left side, including the gums of the lower and upper jaws and the palate, to the median line, and extending back as far as the edge of the soft palate. It involved the tongue, reaching as far back as its base. This area was tested by cotton and the light stroke of a camel's hair brush, by the pricking of a pin, by pinching, by squeezing the parts, by the application of ice water in a tube, and of very hot water, and it was also tested for the sense of position and deep muscular sensibility, so far as was practicable.

The patient showed an absolute loss of all these forms of sensibility to touch, pain, temperature, deep pressure and movement of the parts. With my one finger in the mouth and the other outside, a pressure between thumb and finger caused no sensation, no matter how severe the pressure. A pin driven through the cheek caused no sensation whatever, and by various repeated tests, running over the various areas, for nearly an hour, I was able to convince myself that there was absolutely no form of sensation present in the areas indicated. However, it was easily seen how one could be deceived in such an examination, for if the needle or any hard substance was touched upon the chin, so as to produce a little pressure thrown upon the hard parts below, he appreciated the fact that something was being done to him there. He could also guess at their being some irritation if the cheek were moved or stretched in any way by the stimulus, so that, unless the tests were applied very carefully, he could, through recognition of pressure on the hard parts below, or stretching of the neighboring sensitive parts, appreciate the fact of there being some sort of sensibility there.

The area of sensibility made out for the third branch, is different, as will be seen, from that usually given in cuts.



Showing the Area of Disturbed Sensation in Case 1.

At the last examination 11 days after the operation the area of anesthesia was the same. Tests applied to the ear and meatus showed no anesthesia. The patient could not tell whether the left angle of his mouth was stretched and the mouth open or not. He could draw his mouth to the left in varying degrees but not evenly or accurately, and he overdid it when told to pull his mouth to the left. In other words he had anesthesia of deep sensibility.

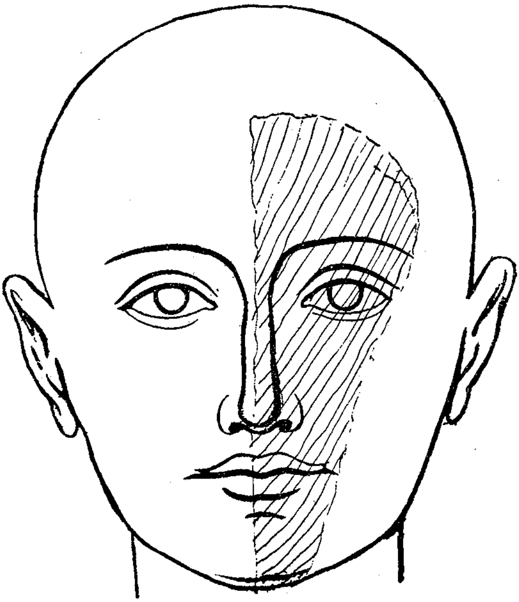
Needles thrust into the gums of both upper and lower jaw caused no sensation, (anesthesia of periosteum).

Two months later the patient is still feeling well in health, but he writes that the "numbness" of his cheek and mouth are the same.

COMPLETE LOCAL ANAESTHESIA IN A CASE OF HYSTERIA MAJOR.

A case of major hysteria in a male shows a somewhat similar condition of almost complete loss of sensation over part of the area supplied by the trigeminus.

The patient, a man aged 40, a mechanic, after a long period of hard, responsible work, received a shock by seeing someone injured. A few hours later without especial cause he felt a shock go through his left side and he fell down unconscious. I saw him two months later. He then had a left partial hemiplegia involving only arm and leg, with some lessening of the deep reflexes on that side, no clonus, no "Babinski." He had a complete left-sided anesthesia to touch, pain, temperature and deep sensibility. He had concentric limitation of visual field of left eye, bone deafness of left ear, loss of taste and smell of left side.



Showing the Area of Disturbed Sensation in Case 2.

A week later the hemiplegia had improved, the cutaneous anesthesia had gone except on the face. The visual and auditory conditions were not changed.

I examined his trigeminal anesthesia at this time on two occasions. He had absolute loss of sensation to light touch and to heavy touch, loss of localization, loss of sense of both heat and cold even to very hot or cold (ice) objects. Very heavy pressure seemed to be felt. There seemed to be appreciation of the prick of a pin as a pressure not as pain. The limitations were quite sharp, and there was corneal anesthesia.

Two months later this anesthesia had also disappeared but he had still some limitation of the visual field. Otherwise he was nearly well except for headache, nervousness, hysteria, tremor and inability to concentrate and do mental physical work.